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Structural change in Dutch agriculture, impact on farm level statistics

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ABSTRACT

Structural change has been a constant factor in agriculture, the Netherlands included. For decades the number of farms has decreased and the size of farms has increased. Agricultural statistics help to analyse and understand structural change, but at the same time structural change affects and to some extend complicates the compilation and use of agricultural statistics. Developments in the size of farms and the number of farms, although often used as indicators of structural change, have a limited impact on agricultural statistics. Other factors such as the increase in complexity of agricultural holdings have a potential large impact.

Keywords: structural change, farm level statistics, complexity

1. Introduction

In this paper the structural change in agriculture in the Netherlands will be described. Section 2 describes the driving forces of agricultural change as described in literature. Subsequently section 3 describes how structural change has had an impact on agricultural statistics and what kind of strategies are implemented to solve these problems (section 4). In this paper we focus on the impact on farm level statistics such as the Farm structure survey (FSS) and the Farm accountancy data network (FADN).

2. Driving forces of structural change

Structural change has been of large interest to policy makers and agricultural researchers. Several studies on structural change have provided a list of factors that determine structural change. Zimmermann et al. (2009) derive 8 factors from these studies. The factors identified are technology, off farm employment, policy, human capital, demographics, market structure, social setting and economic environment.

We will highlight some of these factors. With respect to technology Zimmerman et al. refer to Cochrane's treadmill. Technological innovation reduces the per unit costs. When adoption spreads, competition increases and prices will go down. This forces the others to adopt this technology or leave the business which leads to structural change. Another effect of technology not described by them is the increase in labor productivity. In the Netherlands still many farms are run as family farms. Investment in new labor saving technologies allows the farmer or the farming family to run a larger farm with the available family labour or allows for off farm employment.

In this way, off farm employment can sustain small farms or even subsidize the farm from other income sources. Off farm employment can also be considered as the first step out of agriculture. If wages outside the agricultural sector increase it becomes more attractive to allocate more labour to off farm activities. Increase in wages can also lead to a pressure to increase the scale of the farm to achieve similar income levels as outside of agriculture.

Policies affect structural change. Measures from agricultural policies such as subsidy payments, price support, and production quota have an impact on the structural development of the sector. Peerlings et al. (2010) and Zimmerman and Heckelei (2012) for example describe the impact of the EU dairy policy on the structural change in the dairy sector in different regions in Europe. Besides agricultural policies, also other policies on taxes, social security, inheritance, credit programs can affect the structural development. In the Netherlands also environmental policies influence the development of farms by setting restrictions on the environmental pressure of farms (for example the policy that the growth of dairy farms depends on its mineral surplus and the possibilities to process these surplus minerals (de Koeier et al. 2014).

Human capital refers to schooling and management skills. Demographics refer to the age structure of farming and the availability of successors. Market structure determines the market power and therefore the setting of prices, but also the local opportunities for short supply chains (like on-farm sales). Besides market structure, also organisational structure should be mentioned. Vertical and horizontal integration has had a major impact on the agricultural sector, although the impact on structural change of agriculture is less clear. Social setting is mainly linked to the societal and individual motivations of family farming. The economic environment as a driving force for structural change refers to macro-economic developments such as price developments (especially also of labour income outside farming), exchange rates and interest rates.

This is a wide set of factors affecting structural change. Most of these factors are not directly captured by agricultural statistics. Some information is available on off-farm labour and income. Analysing these factors therefore asks to include information from other sources, apply a more case based approach or to infer proxi variables (productivity as a proxi for technology). In the next section we will describe the structural change in Dutch agriculture.

3. Structural change in Dutch Agriculture

Dutch agriculture has shown a continuous decrease in number of farms (see figure 1) and a continuous increase in the scale of production. Since the seventies the number of farms has decreased 2 to 3 percent every year. After 2000, this decrease has even accelerated. The explanation of this decrease is a combination of economic, technological and policy related factors as described in the previous section. Increased labour costs in combination with technical innovations enabled the reduction of labour input and the increase of the size of the farm that could be managed by one farmer. The increased labour costs also reflect attractive incomes in the booming economy outside agriculture. New juridical and financial structures further increased the scale of production.

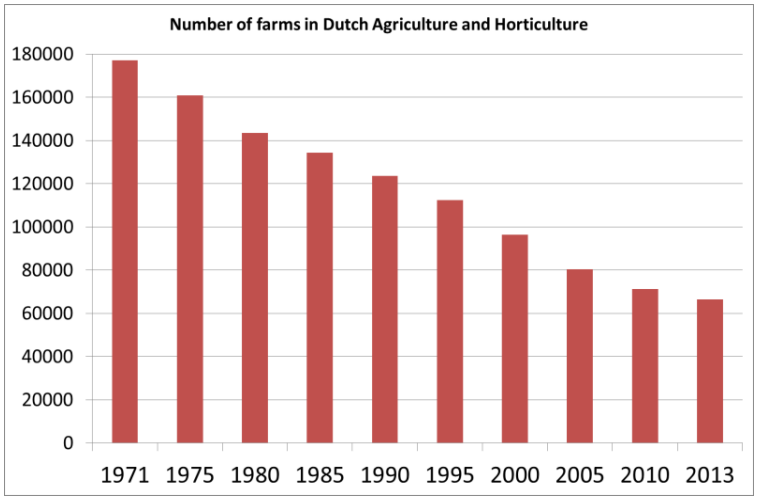

Figure 1 *Decrease in number of farms*

The continues increase in the average size of farms does not mean that all farms follow a similar growth path. The farming population is and always has been a heterogeneous group. Besides farm characteristics and the environment in which a farm is operating, it is also strongly influenced by different farm strategies. Some farms have chosen for a strategy of growth to grasp the benefits of economies of scale. Others have chosen a strategy of diversification of income sources by developing other off and on farm income activities. For still others the farming activity is just a hobby activity, which is not run (or only partially) to provide a source of income.

This is illustrated with figure 2. This figure shows that especially the mid-size group has declined over time (period 2000-2014). The group of small farms has remained stable at a percentage of around 25 percentage of the total farm population. The largest size group has shown a substantial increase (in number of farms and especially in the share of the production value). The mid-size group is declining because it is too small to remain competitive and too big to be run as a part-time or hobby farm.

Given these different farm strategies and differences in the developments of farms, the average size of the farm is more and more difficult to interpret. Therefor Lund (2004), later adopted by the OECD, have introduced the mid acreage or mid livestock indicator, meaning that 50% of the acres or 50% of the livestock can be found at farms larger than this mid-point and 50% on farms smaller than this mid-point. We will illustrate this indicator based on the developments in the dairy sector over a long time period.

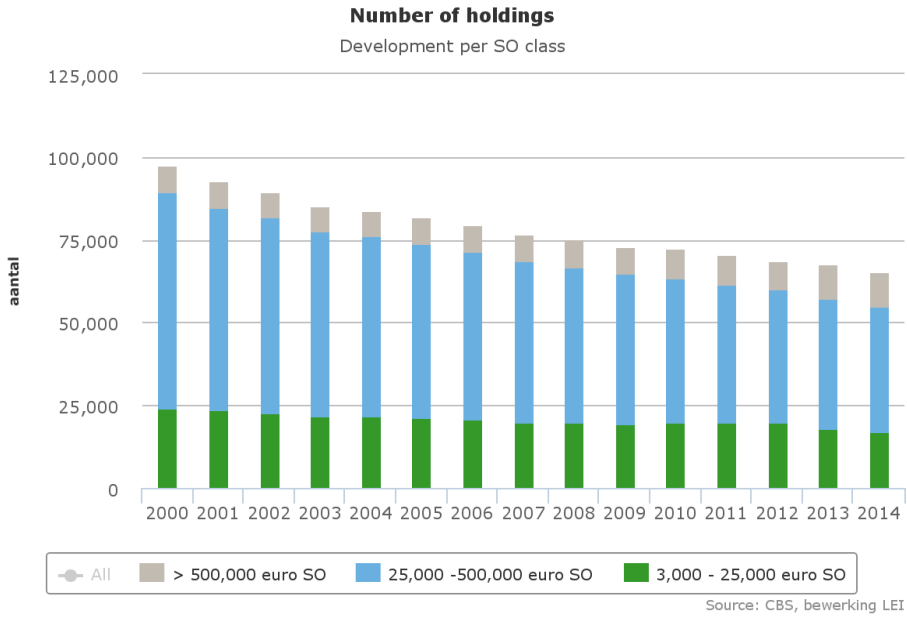

Figure 2 *development in the size distribution of farms*

The dairy sector has always been an important sector in Dutch agriculture and structural change is clearly reflected in the developments of the dairy sector. In 1970 there were still more than 110 thousand farms with dairy cows in the Netherlands (see figure 3). The average number of dairy cows was about 25. In 2014 the number of dairy farms decreased till about 18 thousand and the average herd size increased till 84. Although still limited compared to the development in some other countries, also the Netherlands shows rapidly increasing herd sizes. The mid livestock point in 2013 was above 100 dairy cows (50% of the cows are in herd sizes of more than 100 cows) and the 75 percentile of this indicator increased till above 140 cows (25% of the cows are in herd sizes above 140). Despite this strong growth in size of dairy farms, the dairy sector still consists to a large extent of family farms.

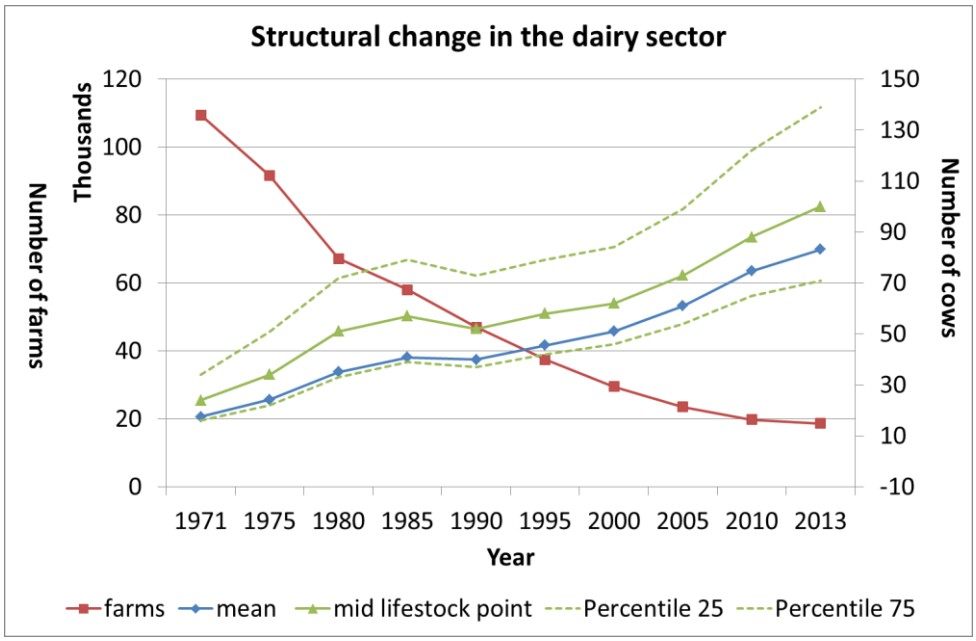

Figure 3 *Structural change in the dairy sector*

Compared to the dairy sector, the development of the landless sectors (intensive livestock and glasshouses) have even shown a much more rapid development. The average vegetables glasshouse increased from 1 hectare in 2000 till more than 3 hectares in 2013.The mid acreage point increased during that same period from 2 till more than 7 and the 75th percentile increased from 3,5 till 14 hectares.

This increase in farm size has been accompanied by large changes in the organisational and financial structure of farms e.g. to handle business risks (and separate family savings or spouse's income from the business, or to manage production in different locations. The traditional family farm (although still dominant in some of the sectors) has been replaced by limited companies and other juridical structures involving the cooperation of several farm holders.

4. Impact on agricultural statistics

Structural change has often been studied based on the developments in number of farms and size of farms in different sectors (Goddard et al, 1993; EU, 2011; Offerman and Margarian, 2014). These factors are relatively easy analysed and well described by agricultural statistics. Also in the Netherlands the agricultural census provides meaningful data to describe these developments (as reported in section 3 above). Size and number of farms have however a limited impact on agricultural statistics. Other factors reflecting structural change (Jaklic et al., 2009; Goddard et al, 1993) have a much bigger impact on agricultural statistics. Table 1 gives an overview of the factors of structural change and its impact on the compilation and use of agricultural statistics. These impacts will be further elaborated in this section.

Table 1 *Characteristics of structural change and impact on agricultural statistics*

Factors of structural change	Impact on agricultural statistics
Increase in size of farms	Limited, small farms often cause the largest problems;
	Increase in record keeping facilitates data collection
	Impact on sampling plans
Larger dispersion in size	Need for other indicators (average has limited value)
	Increased risk of disclosure
	Choice of allocation mechanism in sampling becomes more relevant: e.g optimal vs proportional
Decrease in number of farms	Cheaper census, less elements
	More difficult to include sample elements of small strata;
	Impact on sampling plan
Increased specialisation	Easier data collection, less relevant data items Could improve or complicate benchmarking
Increased complexity (vertical and horizontal integration)	Definition of a farm becomes more unclear

	Increased risk of different definitions in different administrative / statistical / commercial systems
	More difficult data collection (in case different intertwined activities in bookkeeping)
	More difficult recruitment in voluntary sample
	Difficult separation of agricultural and nonagricultural activities and agricultural outputs can be hard to observe and value if they are input to another product (e.g. maize for energy production)
	Complicates use of data for benchmarking
Financial structure	Other indicators needed
Increase in Multi household farms	
	Decreased feasibility of collecting off-farm income
	Increased complexity of collecting farm demography
	Multi dm's increase complexity of farm recruitment in voluntary samples
Age structure	Young farmers better educated, more used to recording
Farm entry / exit	Difficult to capture with current statistics, especially in voluntary systems

Increase in size of farms

An increase in size does not necessary complicate agricultural statistics, in practise often the small farms cause problems (Pedersen, 2013). If the increase in size continues it could lead to changes in the structure and management of the farm that do have a strong impact. The increasing organizational complexity of farming establishments can affect data collection, accuracy of estimates, and the use of data, e.g., in multivariate and policy analysis, disclosure, and dissemination of estimates (Ahearn, 2013).

Increase in dispersion in size

Structural change affects the sample design procedures applied in agricultural statistics. Most countries apply a disproportional stratified sample in their Farm Accountancy Data Network (FADN) or other business-related statistics with a type of Neymann-allocation to allocate the sample capacity to the different size classes. The calculation of the heterogeneity is often based on the variance of the economic size in a stratum. Due to structural change and the increasing farm size the heterogeneity in the largest stratum increases rapidly. Applying the Neymann allocation could therefore results in a large shift of the sample capacity to the largest strata in each of the types of farming. Taking into account the non-response rate, extra work on bigger (more complex) farms and the decreasing number of farms this results in infeasible sampling plans. An increased dispersion of farm sizes could make indicators such as averages more difficult to interpret and creates a need for alternative indicators (Lund and Price, 1999).

Decrease in number of farms

A decrease in number of farms reduces the costs of a census as data on less farms needs to be collected. However, such a decrease could complicate sample statistics because the choice of farms in a certain strata is more limited, which could increase the recruitment costs. Furthermore changes

in the distribution of farms over different farm types might require an adjustment of the sampling rates in different strata. In the use of the data, a decrease in population numbers could make it more difficult to publish results of subgroups because of a lack of data.

Increased specialisation

Given the trend to specialize production, the number of mixed farms is decreasing in almost all countries at a stronger rate than the farming population in total. Data on specialised farms are often more easy to collect (less relevant data items) and more easy to use (no arbitrary allocation of overhead costs and inputs to different agricultural activities). One exception is specialisation in niche markets (for example in horticulture producing a specific flower or plant). Such specialisation could reduce the willingness of farmers to participate due to a lack of relevant benchmarking information and the perception that data is competitive sensitive information.

Increased complexity

Changes in the legal structure of enterprises, multiple households related to one agricultural holding, agricultural activities intertwined with other commercial activities or other on and off farm income sources raise serious conceptual and practical questions.

A large share of farms supplement their farm income with income from other sources (off farm and on farm). Besides the traditional other gainful activities such as cheese production, nature management and farm tourism, also other activities such as care farming, investments in renewable energy (digesters, wind mills) become more and more important. Sometimes these activities are conducted in the same business holding, sometimes separate legal entities are started for these activities.

All these issues affect the definition of a farm and the farming sector. The definition as applied in agricultural statistics ‘a single unit, both technically and economically, which has a single management and which undertakes agricultural activities’ (REGULATION (EC) No 1166/2008) becomes more difficult to apply in practise.

There is an increasing difference how a farm is managed in practise and how the farm is recorded in the agricultural census. In the Netherlands more than 5% of the farms as recorded in the Farm accountancy data network have multiple recordings in the agricultural census. The reason of these multiple recordings can differ from manure application laws, entitlements for subsidy payments, financial and organisational structures (like having bought a farm at a second location that is then integrated in the mother farm but legally still registered as a separate farm).

This complexity also affects the participation rates in FADN. To some extent it is a challenge to fit in these complex structures in the normal FADN data collection, therefore data collectors might be tempted to exclude these type of enterprises from the sample which might result in a biased sample. Furthermore also the respondents might refuse to participate because they feel less connected to the agricultural sector and might not consider themselves as a ‘representative’ unit to be included in agricultural statistics (Vrolijk, 2005).

Financial structure

The idea of a family farm which is operated with a lot of own assets and some bank loans to finance new investments is becoming less common. Farming is a capital intensive activity, and therefore often requires large long-term loans. These developments have an impact on data collection and especially on the use of the data. In the use of the data this means that also an indicator like family farm income is a less suitable indicator to compare the profitability and distribution of income of farms. Johnson et al.(2007) propose to use net value added (NVA) at the micro level to reflect the participation of a wide variety of stakeholders (e.g. banks, land owners, paid labour) in the organization and output of farms.

Multi household farm business

The increasing complexity of farm structures is also shown in the increasing complexity of collecting off farm income statistics and an a decreasing trend of the willingness among farmers to provide these data (increase in item non response). This not only asks for a re-evaluation of the relevance of off farm income for the operation of the farm, but also a revision of instructions which data items to collect for which persons in which households. (data for only the spouse of the farmer in family farms, or also for a broader set of household members of the farm holders of multi household farm holdings). Multi household farm businesses could also complicate recruitment processes in voluntary data collection because the commitment of several persons is needed.

Age structure

Old farmers are often less willing to participate. An ageing farm population could therefore make recruitment of farmers for a system like FADN more difficult. Willingness of participation is lower due to the idea that the farming business will end or be transferred in a few years' time. Furthermore there is a link between age structure and level of (agricultural) education. A higher level of education leads to a higher interest in useful management information and the willingness to benchmark farm performances and therefore increase the willingness of participation.

Farm entry exit

Farm entry and exit is an important indicator of structural change but is difficult to fully grasp by agricultural statistics. The farm accountancy data network (FADN), which provides extensive information on the economic performance of farms, is organised as a rotating panel, and the current statistics do often not allow determining whether a farm exits the survey due to the closing down of the farm or other reasons (Offerman and Margarian, 2014). The farm structural survey on the other hand provides information on farm entry and exits but also there it requires further analysis to understand the development of farms (merging of farms, change in juridical structure etc.).

5. Solutions and Future steps

Given the structural change of Dutch agriculture as described in section 3 and the potential impact of structural change on the compilation and use of agricultural statistics as described in section 4 there are some important challenges in the system of agricultural statistics. This section describes some principles and initiatives in the Netherlands to handle these challenges. Figure 4 provides the framework with drivers of structural change, the indicators of structural change, the impact on statistics and the strategies for the future. These strategies focus on the definition of the farm, the way of collecting data, the way of involving farmers and the need to reconsider the whole system of agricultural information.

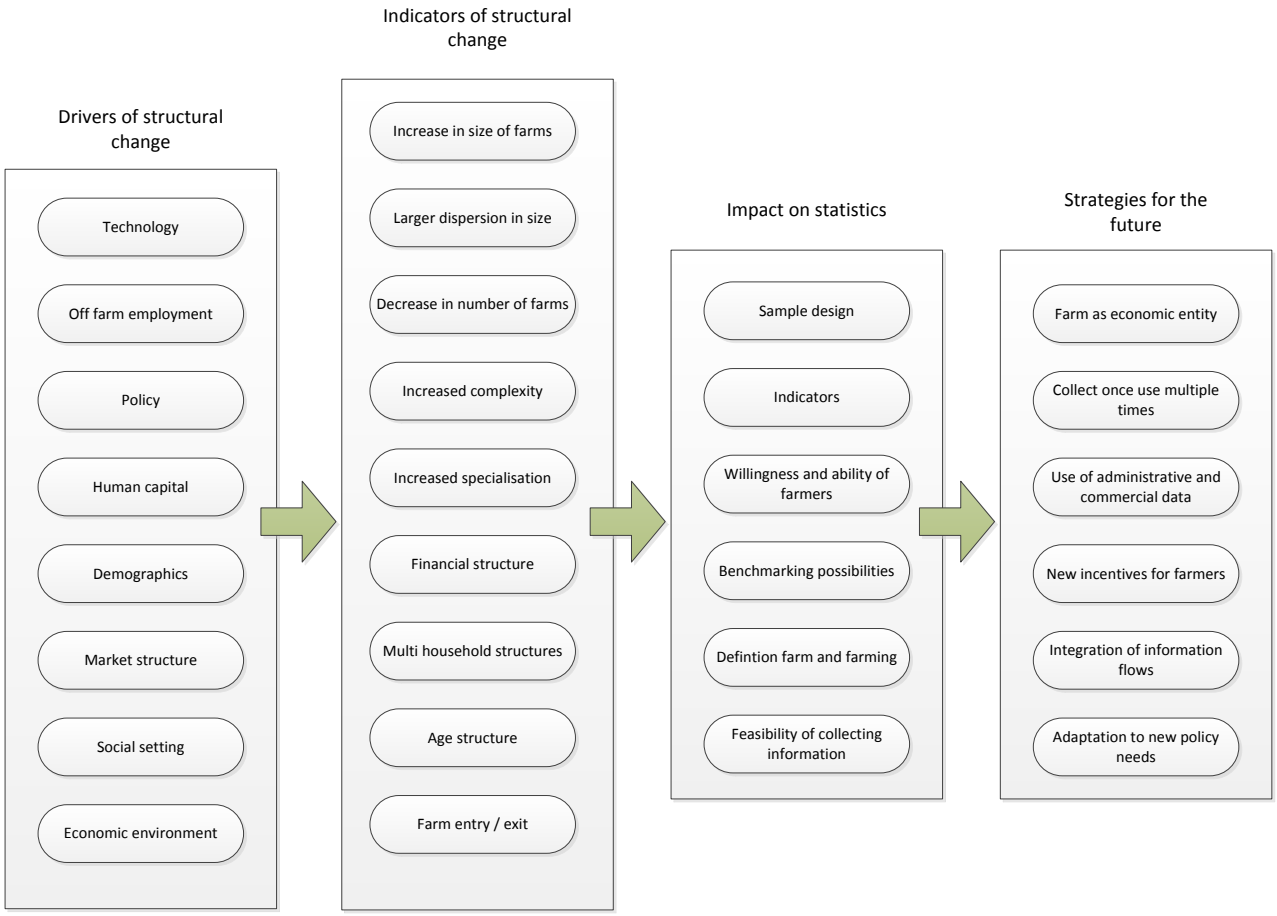

Figure 4 *structural change and the impact on future strategies in agricultural statistics*

Definition of the farm and farming sector

In the past farmers who were in the farm register received an invitation to submit the agricultural census. Due to the focus on active farmers in the current CAP, the population of the agricultural census has been redefined as those enterprises registered at the chamber of commerce as an agricultural producer (according to the NACE coding system). This registration as an agricultural producer is also a requirement to receive agricultural subsidies. Besides adapting to changes in the CAP, this change also reflects the trend in the Netherlands that agricultural enterprises are treated as any other economic sector.

Collect once use multiple times

In Dutch agriculture there is an increasing group of farmers who only want to share information if it does not take too much of their time. For those farmers, the traditional data collection methods of a data collector and the farmer filling in forms at the kitchen table does not work anymore. This is not only true for farmers, but for all entrepreneurs. An important policy objective of the Dutch government is the reduction of the administrative burden. One of the core elements of this policy is the ‘collect once use multiple times’ principle. The government can only ask a specific data item once. If this item is needed for other administrative or statistical purposes the already collected data should be reused or the data collection should be integrated. This has resulted in an integration of data collection for administrative and statistical purposes.

Increased use of administrative and commercial data

As a next step, large benefits can be gained by re-using not only administrative data but also commercial data. In the Dutch FADN system there is a strong focus on the re-use of existing data to lower the administrative burden, to increase the efficiency of data collection, to increase the quality of the data and to enable a wider set of analysis. In Dutch FADN a wide set of data sources is used to compile the farm (bookkeeping) data. Figure 5 illustrates the data sources used. This varies from bank transactions to use of animal medicines, and from electronic invoices to information on the manure flows. All these data sources are used to compile the recordings for individual farms. At the end of the year, the system generates a list of missing data items which should still be asked from the farmer (for example labour hours or allocation of inputs to different crops). In this way the administrative burden for farmers is minimized by only asking the farmer, if there is no other information source available.

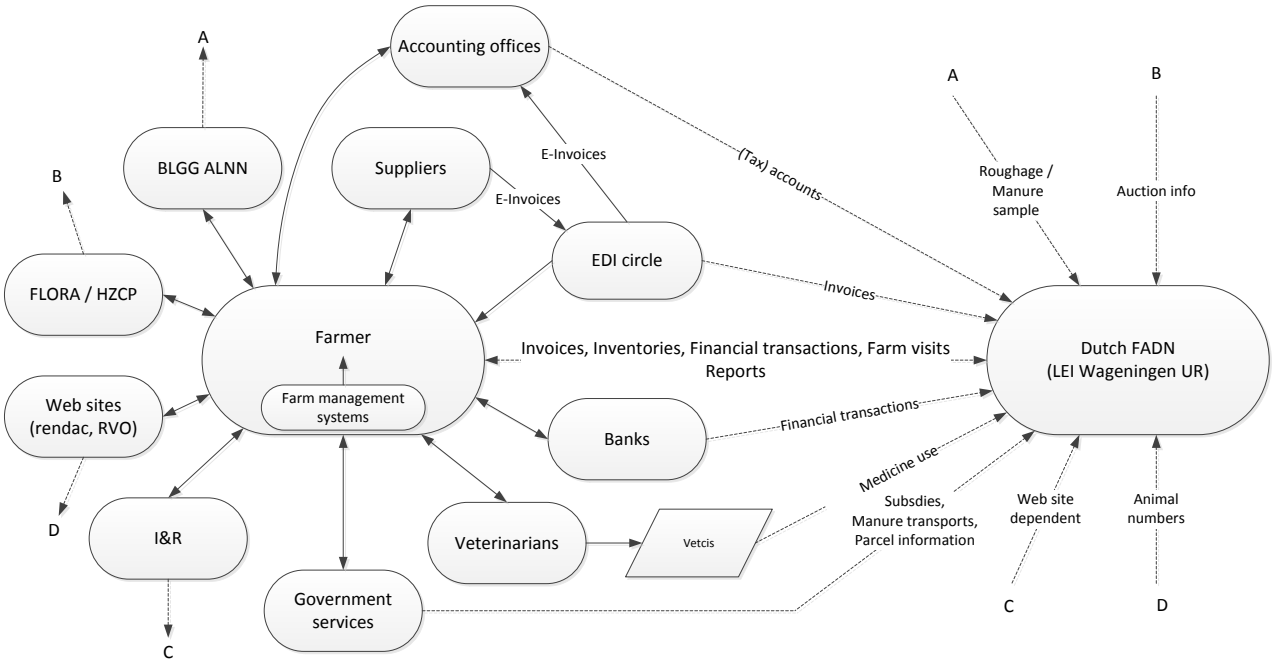

Figure 5 *Data sources in Dutch FADN*

Incentives for farmers

In these systems it is also increasingly important to consider the benefits to farmers and the farming sector to share this information. New concepts need to be developed where all stakeholders benefit. Other incentives for farmers to participate are needed.

6. Discussion

This paper described structural change and the impact on agricultural statistics. Responding to these developments requires the adaptation of the content and working procedures on agricultural statistics. It is important to realise that this is not the only need for agricultural statistics to adapt.

Also the requirements for agricultural statistics change. New policy and research topics emerge that need to be analysed and for which relevant information is necessary. This requires the adaptation of the system of agricultural statistics to the new policy needs. At the EU level this is a slow process. In the Netherlands the ability to adapt to these changes has been a core design principle in the national FADN.

In this paper we have focused on farm level statistics. Structural change also has an impact on other types of agricultural statistics, such as price statistics. In certain sectors price statistics become more difficult to compile because of an increased heterogeneity in production (due to a strategy of product specialisation and niche markets) and due to a concentration in production and in chain actors. As a consequence, price information is more and more treated as competitive sensitive information. Also changes in the marketing of products from auctions to direct contracts reduces the availability of price information. Although some of trends make the access to information more difficult, at a broader scale the availability of information only increases.

With the trends of big data, internet of things and precision agricultural the availability of information will only further increase. Also the need for information in the agro food sector increases continuously. Traceability, certification, labelling, production planning require detailed data on production and production processes. This makes it even more necessary to consider the whole system of information flows in the agricultural sector to achieve a synergy between the different needs and applications.

All these developments make it necessary to not only look at the needs for agricultural statistics. Agricultural statistics should be an integral part of the whole system of information needs and information flows in and about the agricultural sector.

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